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FINANCIAL INCENTIVES AND POLLUTION CONTROL

A CASE STUDY

PENNSYLVANIA STATE UNIVERSITY

PREPARED FOR

WASHINGTON ENVIRONMENTAL RESEARCH CENTER

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Confronted with shortages of low-sulfur content residual fuel oil, several air-pollution-control authorities in the northeastern states were forced to relax air-quality standards during the winters of 1972-73 and 1973-74. The authorities did so by granting variances to their sulfur-content standards for residual fuel oil. The characteristics of these variances provide the social test-tube for this analysis. The report examines alternative policies such as direct regulation, fuel-oil surcharges, emission taxes and quantity control.

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ii

ABSTRACT

The past decade has witnessed a concerted effort to clean up the environment. Legislation has been relatively successful in achieving this objective. Nevertheless, as the recent energy crisis has demonstrated, legislation is not a panacea and regulations must often be circumvented. Yet, environmentalists resist even temporary relaxation of ambient air-quality standards in the face of severe hardships because they feel "the pressure must be kept on." Economists argue that applicants for variances from regulations often have financial incentives to overuse such permission; caught in the middle, public officials must decide the worthiness of variance applications and how to assure continuing progress toward compliance with air-quality regulations if a variance is granted.

Confronted with shortages of low-sulfur content residual fuel oil, several air-pollution-control authorities in the northeastern states were forced to relax hard-won air-quality standards during the winters of 1972-73 and 1973-74. The authorities did so by granting variances to their sulfur-content standards for residual fuel oil. The characteristics of these variances provide the social test-tube for this analysis.

Extensive investigation of variance strategies have shown that a general (uniform) variance structure coupled with a fuel-oil surcharge represents a desirable variance policy. The report recommends, however, that a fuel-oil surcharge should be designed to more than compensate for the price (and/or profit) differentials between conforming and nonconforming fuel oil. The report also examines alternative policies such as emission taxes and quantity controls.

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TABLE OF CONTENTS

		Page
Abstract		ii
Acknowledgements		iv
SECTIONS		
I	Introduction, Summary and Conclusions	1
	Introduction	1
	Background	2
	New York City Perspective	3
	The Regional Perspective	7
	Institutional Analysis	10
	Design Criteria	10
	Analytical Work Plan	11
	Definitions	12
	Variance Policy Scenarios	13
	Conclusions and Policy Recommendations	17
	Appendix A	21
II	New York City Perspective	27
	Background	27
	1972-73	28
	1973-74	34
	Appendix B	39
III	The Regional Perspective	41
	New Jersey	41
	1972-73	41
	1973-74	42
	Massachusetts	43
	1972-73	43
	1973-74	44
	Connecticut	46
	1972-73	46
	1973-74	46
	Appendix C	48

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SECTION I

INTRODUCTION, SUMMARY AND CONCLUSIONS

INTRODUCTION

By most forecasts, a shortage of such energy resources as oil will continue in the years to come. These shortages are a result of society's interest in a relatively clean air mass and a continually growing desire for energy-intensive goods and services. Given this juxtaposition, it is reasonable to expect that the frequency of shortages of environmentally acceptable fuels will increase.

Because of these probable shortages, it is particularly appropriate to investigate alternative approaches to the Nation's pressing energy problems. This report examines one such category--the use of fuel-oil variances or exceptions to air-pollution-control laws employed during an energy-environment crisis that occurred in the northeastern United States during the winters of 1972-73 and 1973-74. Extensive interviews were conducted with the central participants from public regulatory bodies and relevant fuel-oil suppliers and distributors in Connecticut, Massachusetts, New Jersey and New York. These interviews allowed the authors to produce an instructive portrait of the events surrounding the use of the variances.

Despite the opportunity to interview the principal actors, international uncertainty and a vacillation of national policy contributed to an unusually high degree of confidentiality within the oil industry. This confidentiality preempted any comprehensive empirical analysis. As a result, this report provides a qualitative review of the complex and interdependent political and economic events surrounding the use of variances for the sulfur-content standards of fuel oils. In addition, the

report provides recommended design criteria for regulatory agencies should responsive fuel-oil variance policies be needed in the future. Finally, the report evaluates alternative variance strategies and recommends needed reforms for achieving a more efficient variance policy.

BACKGROUND

Ever since A. C. Pigou published *The Economics of Welfare*, economists have advocated the use of corrective taxes and subsidies as a means of modifying the misallocation of resources due to market failures. In general, a misallocation of resources results when a decision-maker is insensitive to the total costs and benefits associated with his actions. In order to correct such misallocations, economists have argued that activities that exert costs on others be taxed an amount equal to this cost increment; hence, decisions would be made *as if* in full cognizance of the total costs and benefits.

The case for the use of financial incentives as a method to induce pollution abatement relies on these same principles. As pollution is made expensive relative to pollution control, more pollution abatement will be selected by the cost-minimizing entrepreneur. Thus, the greater the degree of pollution abatement desired, the higher the tax or penalty rate should be in order to provide the desired incentives. This report attempts to evaluate this argument's applicability to a situation in which there was a shortage of environmentally acceptable fuel and a desire to maintain previously formed clean-air standards. Such a situation occurred during the winters of 1972-73 and 1973-74, when the northeastern United States experienced a shortage of low-sulfur content fuel oil at a time of critical concern over ambient concentrations of sulfur dioxide.

The novel variance approach employed during the winter of 1972-73 and again in the early part of the following winter by New York City's Environmental Protection Administration (NYC EPA) plays a central role in the analysis that follows. The decision framework instituted in New

York City differed significantly from that of the surrounding areas, and this framework is employed as a base point for this report.

THE NEW YORK CITY PERSPECTIVE

Sulfur emissions in New York City were significantly reduced following compliance with a series of laws passed since 1967 that mandated the maximum allowable sulfur-content of residual oil to be 0.3 percent by weight. By 1972, the City's air quality conformed, in most instances, to the federal standards. During the early winter of 1972, various oil suppliers, terminal operators, and distributors were expressing fears, both formally and informally, of a supply shortage of conforming (0.3 percent) fuel oil. These fears were later reinforced and participants involved in supplying fuel oil began to submit formal requests asking for relaxation of the sulfur content restrictions from 0.3 percent up to the 2.8 percent level.

The importance of these requests for variances or exceptions to existing air-pollution control laws can only be appreciated when it is recognized that residual fuel oil represents about fifty percent of New York City's total annual energy consumption. More than sixty percent of the City's housing units are heated with residual oil, and it is the primary fuel used for electrical generation. An average of 110 million barrels of residual fuel oil are burned annually, and this is divided almost equally between Consolidated Edison (52 million barrels) which supplies the City's electricity and direct space-heating applications (58 million barrels). New York City requires nearly ten percent of all residual fuel oil consumed in the United States and, without question, the City is more dependent on residual oil as a proportion of its total usage than any other area of the country. Thus, while residual fuel oil represents only seven percent of the total national usage, it is the lifeblood of New York City. Hence, a double-edged sword of significant disruptive potential faced New York City's Environmental Protection Administration in the early winter of 1972-73. On the one hand, the possibility of regulation-induced supple shortages of conforming fuel oil could cause

serious health and economic problems. On the other hand, high-sulfur oil to meet the supply needs would jeopardize the City's precarious and hard-won air quality.

To understand the economic incentives that were in effect in New York City's fuel-oil market during 1972-73, it must be recognized that distributors purchase residual fuel oil in large quantities from primary suppliers under contractual agreements that are normally consummated months before the heating season. While these contracts can have option clauses as to amount purchased (since total demand is dependent upon meteorological conditions), the consumer is indifferent to the oil's sulfur content. In general, these contractual agreements do not recognize the oil's sulfur content as a price-relevant item, that is, once the contract is completed the price per barrel is independent of the oil's sulfur content. Consequently, only regulatory controls influence the contractual agreements between the distributor and the supplier with respect to sulfur content. Thus, significant economic incentives exist on the part of the fuel-oil suppliers to seek and obtain variances from sulfur content standards. Higher-sulfur residual fuel oil (i.e., two percent) was cheaper than conforming residual fuel oil by approximately two dollars per barrel and in the million barrel quantities transacted in New York City, large windfall profits would accrue to those suppliers and/or distributors who were successful in obtaining variances.

Recognizing this major profit incentive to obtain variances from the air-pollution-control laws, the local air-pollution administrators were duly concerned. Aware that their information on the availability of conforming fuel oil had to be obtained from industry spokesmen, and then often indirectly after some time lag, the regulatory officials recognized that they were in a precarious position and would not be able to establish the "need" upon which they were mandated by law to base their variance decisions. Further, the NYC EPA had the authority to grant either *general* or *specific* variances. A *general variance* allows unlimited sales and usage of nonconforming fuel oil while a *specific variance* permits certain suppliers to sell designated consumers specified

amounts of nonconforming fuel oil over defined periods of time. The latter procedure was discarded because the potential administrative workload was beyond the NYC EPA's manpower capabilities. Moreover, a variance granted specifically to a supplier-consumer couplet would grant windfall profits to the supplier and effectively protect him from encroachment on his market share.

Once a decision had been made to use general variances, conditions were attached to the variance* that required a surcharge be paid to the city in an amount equal to the number of barrels of nonconforming oil multiplied by seventy-five cents for those barrels containing between 0.3 and one percent sulfur, and multiplied by two dollars for those barrels containing between one and two percent sulfur.+ In effect, the surcharge eliminated the incentive to supply *only* nonconforming fuel oil since the surcharge tended to remove windfall profits that would have resulted from the introduction of the higher-sulfur fuel oil. Thus, this general variance with a fuel-oil surcharge opened the market for nonconforming oil and prevented a monopoly profit from being granted to the suppliers who could not conform. Further, this variance strategy promoted sulfur competition by encouraging the entry of more nearly conforming grades--an incentive that would not have been present without the surcharge--while avoiding shortages.

In retrospect, there are indications that this variance strategy did operate as a pronounced deterrent to the use of nonconforming fuel oils during the 1972-73 heating season. Although temperatures during the first three months of 1973 were slightly higher than the previous year, demand for residual fuel oil had, in fact, been accentuated due to shortages of

*Since the NYC EPA is not a legislative body, it does not have the power to levy taxes, and since it is not a judicial body, it does not have the power to fine or penalize behavior. Therefore, the surcharges were described as "conditions of variance."

+In order to avoid legal challenges, the surcharge was intended to set the supply price of nonconforming oil at the same price as the relatively low-sulfur substitutes.

natural gas and distillate fuel oil as well as general growth in the economy. By the end of the winter, however, two of the city's major suppliers, who had originally calculated a need for 2,850,000 and 450,000 barrels of nonconforming residual fuel oil, found it necessary to supply only 865,796 and 216,603 barrels of such oil, respectively. Moreover, the variance policy resulted in significant fuel oil borrowing and trading campaigns that reduced the need to bring in additional amounts of nonconforming residual fuel oil.

The next winter (1973-74) is more difficult to analyze. The heating season was characterized by high emotional and political overtones because of the Arab oil embargo, the advent of federal energy policies, and the interaction of multiple price-control systems that tended to differentially affect imported versus domestic oils. Moreover, there was a transfer of the City's mayorality, a shift of New York's governor, the establishment of the Federal Energy Office in Washington, D.C., and congressional promulgation of legislation to amend the Clean Air Act of 1970 (that would, in part, authorize delays in meeting clean-air requirements). These simultaneous changes were unprecedented and of a sufficiently severe crisis nature to render impossible any conclusive policy evaluation. Nevertheless, some insights can be gained from a partial review of the more significant events.

The East Coast, and New York City in particular, were affected more significantly than the rest of the country by the Arab oil embargo because of this area's extreme dependence on imported fuels. During the early part of the winter, a general variance with a fuel-oil surcharge, similar to that specified during the previous winter, was employed. The viability of this technique was weakened, however, as these rather catastrophic shifts in supply began to develop.

Legal and political considerations required that the surcharge reflect only the incremental supply-price differential between conforming and nonconforming fuels and thus was particularly problematic during the second application. The severe dynamics in the national and international

markets caused alarming price fluctuations, and this intensified the difficulty in specifying a surcharge rate that would prevent windfall profits and yet not alter the suppliers' pre-variance profit levels. Published price guidelines in *Oil Buyers' Guide*, for example, lagged significantly behind the going price, and the market deviation from posted prices was more intense than normal. Each company (suppliers and distributors) depending on its supply conditions, was able to deliver oil at differing prices, and most buyers obtained what they could at whatever price. The companies found that they had to ration fuel among their customers disregarding the oil's sulfur content. A buyer who had been shortened on his contract and wanted to buy elsewhere found the prospects quite grim, and the proposed federal allocation program published on December 19, 1973, tended to lock the buyer-seller relationship based on historical patterns. Hence, any incentive scheme to induce consumers to search for environmentally desirable oils tended to become inoperable even before the federal regulations took effect in January of 1974.

The essence of the second winter's experience with respect to the use of fuel-oil surcharges as a variance mechanism indicates that as long as equality of supply price is a relevant criterion, then significant dynamics in the price system tend to vitiate such a policy. Moreover, when demand for all qualities of fuel oil exceeds supply, incentive systems to encourage the use of one type of nonavailable fuel oil over another type of nonavailable fuel oil become politically and economically infeasible. Therefore, the NYC EPA strategically decided to rescind its policy by revoking the surcharges while reserving the right to reintroduce similar regulatory practices when the markets returned to more normal conditions.

THE REGIONAL PERSPECTIVE

In contrast with New York City's variance strategy, requests for variances in Connecticut, Massachusetts, and New Jersey which are all heavily dependent on residual fuel oil, were managed by the states' air-pollution-control agencies on a specific-discretionary basis. The

predominant factor emerging in the formulation of these variance strategies was their dependence on the judgments of a few individuals. In effect, these states relied extensively on strong discretionary control that was contingent upon sparce and often confounding information linkages between state authorities and industrial sources.

In Massachusetts, for example, the authorities were convinced of the authenticity of the claimed shortages in the Boston area during the winter of 1972-73, based primarily on information furnished by oil company representatives. Although originally attempting to review individual cases, the State was forced, in the interest of administrative expediency, to opt for a general 30-day variance policy that allowed one percent sulfur-content residual fuel oil into the Boston region (the prevariance level was 0.5 percent). It is reasonable to conclude that this manpower-intensive variance process succumbed to the spector of severe shortages.

For unknown reasons, only a small quantity of nonconforming fuel oil actually entered the Boston region. On a strictly speculative basis, this may be explained by the fact that one percent sulfur-content fuel oil was also in very short supply. The concurrent events in New York City are relevant to this situation: since New York City represents a significant part of the northeastern residual fuel oil market, the City's fuel-oil surcharge resulted in searching for environmentally desirable fuels. That is, the nonlinear characteristic of the imposed fuel-oil surcharge tended to induce consumers and suppliers to seek the lower-sulfur content nonconforming fuels before resorting to the suppliers of higher-sulfur content fuel oil. Therefore, New York City's policy accentuated the demand for one percent fuel oil in the northeastern market, and, notwithstanding the variance, Boston's suppliers had to search more intensely for the lower-sulfur oil.

As early as July of 1973, Massachusetts' air-pollution-control authorities again received indications from the major oil suppliers that predicted availability of conforming fuel for the upcoming heating season

(i.e., 1973-74) would range between a ten to fifteen percent shortfall. To appreciate the impact of such a forecasted shortage on Massachusetts, the extreme importance of independent oil suppliers in the state must be recognized. Since these estimates excluded the independents, which account for approximately forty-five percent of Boston's market, a shortage anticipated by the major fuel-oil suppliers had to be interpreted in a magnified fashion. Consequently, the midsummer forecasts precipitated extensive public hearings and investigations.

Investigation by the state's air-pollution-control officials tended to verify the likelihood of short supplies during the coming winter, and new regulations were adopted for residual fuel oil. The new residual oil regulations permitted sources using more than 250 BTU (British Thermal Units) per hour to apply for variances to burn residual fuel up to 2.7 percent sulfur content; the previous regulations had permitted only one percent sulfur content oil throughout the state; and 0.5 percent in Boston.

The specification of variances in Boston reflected a joint supplier-consumer relationship. This procedure was designed to provide detailed information to the state air-pollution-control officials which they planned to utilize in order to redistribute conforming fuel oil on the basis of air-shed sensitivity. In effect, the authorities attempted to operate an intraregional fuel-oil allocation and distribution program. The plan's implementation, however, proved to be unworkable since the authorities were overwhelmed with variance requests, which could not be effectively handled within the required time constraints and with the given manpower.

The winter of 1973-74 also posed serious threats to New Jersey's air quality. In particular, early in the season it was apparent that shortages were probable, and a temporary relaxation of the sulfur regulations was adopted, which differentially relaxed the sulfur-content restrictions (from 0.2 percent up to one percent) throughout the state on the basis of air-shed tolerance considerations. In effect, New Jersey allowed a

general relaxation of environmental standards in anticipation of the problems the state was likely to confront. Nevertheless, a major supplier in this state was unable to meet the newly relaxed standards and 285 of their customers formally requested and were granted variances. Three full-time administrators granted the variances on a discretionary basis. This administrative staff utilized information furnished primarily through petition forms and telephone communications with representatives of the various supply firms.

During the winter of 1973-74, Connecticut was also forced into relaxing the state's sulfur restrictions on fuel oil. The major supplier of residual fuel oil for the state's utilities alleged a shortfall of conforming oil and asked for a variance to allow 1.25 percent sulfur content residual fuel oil. Neither the supplier nor the state authorities were able to certify the shortfall, however, as the winter progressed and pressures mounted, a 120-day variance was issued.

The variance policies employed in New York City, New Jersey, Massachusetts and Connecticut all appeared to be relatively successful in terms of the energy-environment tradeoff. That is, serious shortages of fuel oil were avoided and yet the damage to ambient air quality was minimal. It should be recognized, however, that a policy's success during one period is insufficient justification to recommend it for reapplication. The following section will address this issue.

INSTITUTIONAL ANALYSIS

Design Criteria

In light of the experiences of the winters of 1972-73 and 1973-74, this section will develop a set of design criteria to assist policymakers in the selection of alternative variance policies. These criteria reflect an analysis of the events in each of the locations studied as well as present an instrument for ferreting out the common characteristics that permeated the northeastern experience. In essence, the design criteria define the central concerns that must be addressed in the process of designing a variance policy.

1. The management design must be sufficiently flexible to sustain highly dynamic market conditions. Inherently, variances are required in periods of unstable supplies. Therefore, any variance strategy should strive to *minimize its dependence on external information* and be able to respond to requests for exceptions in a rapid and decisive fashion.

2. Since variances can affect profits, it is important that any institutional framework be as *independent* as possible from persuasion by the influenced parties.

3. Since variance strategies can influence public welfare, every effort should be made to design a regulatory technique that does not exhibit "yes or no" characteristics. The institutional design should *promote* the use of low-sulfur fuel oil rather than *prohibit* the use of high-sulfur fuel oil.

4. Since manpower is limited in most air-pollution control agencies, a variance strategy should *treat manpower niggardly*.

Analytical Work Plan

This section will provide an array of variance policy scenarios which will be analyzed in terms of the design criteria. In each case, the advantages and disadvantages are highlighted to illustrate how the guidelines provided in this report can be employed by policymakers in order to analyze any variance procedure. After a brief section devoted to a refinement of terms, an evaluation will be provided in a conjunctive mode of the two alternative *variance structures* (general and specific) and three alternative *regulatory mechanisms* (emission tax, fuel-oil surcharge, and quantity controls) which can be employed within each of these structural frameworks. That is, a variance policy is defined by a structural/regulatory mechanism specification.

Variance Structure--Definitions-

No established dichotomy exists between specific and general variances. All variance structures embody degrees of specificity and generality with respect to suppliers, consumers, duration, quantities, and regions. For example, even though New York City's variance structure was categorized as general, the plan was still restricted in terms of time; alternatively, in Massachusetts specific variances were issued to particular regions without regard to quantity. For purposes of the analysis that follows, a *general* variance structure indicates that all parties involved are dealt with in a uniform manner. Conversely, a *specific* structure treats participants individually.

Regulatory Mechanisms--Definitions-

Besides the use of fuel-oil surcharges, two other regulatory mechanisms will be considered. First, an emissions tax, which is a charge assessed on a polluter that is a function of the output of his environmentally degrading emissions. Such taxes are assessed on a physical measurement of the effluent and can be structured in either a linear or progressive manner. Second, quantity controls which are the direct imposition of quantity restrictions on the use of nonconforming fuel oil on either a regional or local allocation basis.

It should be recognized that a fuel-oil surcharge can be established so as to produce either indifference or preference with respect to supplying and/or consuming nonconforming oil. For simplicity, the variance policy scenarios discussed below that employ a fuel-oil surcharge would be interpreted as a penalty which is sufficiently high to provide an incentive for supplying and/or consuming conforming oil. Thus, if a fuel-oil surcharge does not achieve this criterion, then the following arguments must be qualified.

Variance Policy Scenarios

I. Specific Variance/Fuel-Oil Surcharge

A. Advantages

1. Specific variances enable public officals to exercise a greater degree of control over the allocation of fuel oils than do general variances. Officials can designate areas in which nonconforming oil can be used (i.e., differential air-shed management) and adjust the duration of variances with respect to individual suppliers.

2. A fuel-oil surcharge is relatively simple to administer since it is based on a quantity measure readily available from accounting operations (i.e., no equipment or extensive manpower is required for measurement).

3. A fuel-oil surcharge can reduce the possibility of windfall profits since a surcharge alters profit differentials by favoring conforming over nonconforming fuel oil.

4. A fuel-oil surcharge allows suppliers some latitude in their decisionmaking processes since the surcharge promotes the use of low-sulfur fuel oil but does not prohibit the use of nonconforming oil. That is, no supplier is confronted with rendering a decision as to either furnishing conforming fuel oil or nothing.

5. A fuel-oil surcharge can encourage technological development in desulfurization processes.

6. Revenue is derived from the surcharge.

B. Disadvantages

1. Since specific variances treat individuals separately and because of their inherent restrictions there is an increased demand for and dependence upon external information.

2. Since specific variances inherently confine the consumer-supplier's discretionary authority, the likelihood of scattered shortages increases as additional restrictions are imposed.

3. The setting of a fuel-oil surcharge to alter the price differential (hence altering the profit incentive) between conforming and nonconforming oil is dependent upon knowledge of this differential. In static equilibrium, the manpower necessary for establishing this differential would be minimal, requiring only the solicitation of market information from available sources. In a dynamic situation, however, the information is difficult to obtain and analysis and employment of forecasting techniques would heighten manpower demands. Moreover, the need for continuous updating of information necessitates increased reliance upon affected parties.

4. The revenue derived from this policy has the potential of significantly influencing the rate setting process. That is, the establishment of a fuel-oil surcharge should not be influenced by factors other than promoting the use of conforming oil.

II. General Variance/Fuel-Oil Surcharge

A. Advantages

1. As in I.A.2, I.A.3, I.A.4, I.A.5, and I.A.6.

2. General variances are relatively simple to administer since all participants are treated uniformly. Thus, general variances are less manpower-intensive than are specific variances.

3. General variances reduce the interaction between the public and private sectors since the process becomes

more mechanized at the clerical level. Hence, general variances minimize the involvement and potential interference by the affected parties.

B. Disadvantages

1. As in I.B.3 and I.B.4.

2. Since a general variance treats all participants equally, the degree of control (i.e., differential air-shed management) is substantially reduced.

III. Specific Variance/Emissions Tax

A. Advantages

1. As in I.A.1 and I.A.6.

2. An emission tax permits the concerned parties broader discretionary authority in which to respond. For example, although a firm may respond to this scheme in the same manner as a firm would to a fuel-oil surcharge, the range of response is expanded. In essence, an emissions tax encourages a greater range of technological development (including desulfurization facilities) of air-pollution control equipment. Therefore, it is potentially more efficient than the fuel-oil surcharge.

B. Disadvantages

1. As in I.B.1, I.B.2, and I.B.4.

2. The operational characteristics of an emission-tax policy tend to be costly in terms of manpower requirements since the emission is inherently more difficult to measure than fuel-oil surcharge (which is simply an accounting procedure).

3. Resulting from III.B.2, there exists the greater possibility of legal difficulties which could hinder the implementation of this policy.

IV. General Variance/Emissions Tax

A. Advantages

1. As in I.A.6, II.A.2, II.A.3, and III.A.2.

B. Disadvantages

1. As in I.B.4, II.B.2, III.B.2, and III.B.3.

V. Specific Variance/Quantity Control

A. Advantages

1. As in I.A.1.

2. Once quantity limitations are set, public officials can establish policy rapidly and decisively and continue to administer in a neutral manner.

3. This strategy would facilitate the implementation of either a fuel-switching or fuel-allocation program if necessary.

B. Disadvantages

1. As in I.B.1 and I.B.2.

2. In order to correctly set restrictions on the quantity of nonconforming fuel oil to be used, extensive information with respect to the prevailing market supply of oil is required. Moreover, the implementation of quantity controls results in extreme centralized decision-making by authorities that also requires extensive external information in order to assure that the quantity specifications conform with the availability of fuel oils.

3. Since quantity controls prohibit the use of nonconforming fuel oil beyond some defined limit, shortages will result if this limit is incompatible with the available supply of conforming fuel oil.

4. Quantity controls fail to eliminate windfall profits.

5. Quantity controls provide no technological incentive for the development of air-pollution control equipment.

VI. General Variance/Quantity Control

A. Advantages

1. As in II.A.2, II.A.3, V.A.2, and V.A.3.

B. Disadvantages

1. As in II.B.2, V.B.2, V.B.3, V.B.4, and V.B.5.

While it is appropriate to provide a taxonomy of considerations to be addressed when designing a variance policy, the policymaker must ultimately weigh the various attributes of any given scenario at the time and in the setting of the selection process. That is, the selection of a single policy must be made with a complete recognition of the social, economic, and political characteristics in a given region that only the policymaker, as opposed to the researcher, can appreciate. This in depth understanding in conjunction with this report provides a rigorous instrument for constructing a variance policy.

In light of these qualifications, while this effort must stop short of advocating a single specific policy, the following section will present conclusions and policy recommendations reflecting the investigation's more relevant and important findings.

CONCLUSIONS AND POLICY RECOMMENDATIONS

This investigation has shown that manpower and potential enforceability of any regulation were of paramount concern in the air-pollution control agencies during the period under investigation. Thus, a general variance structure seems preferable because of its administrative simplicity and degree of independence between public officials and affected

participants. The recommended regulating mechanism, however, is a more complex question.

The choice of the optimum regulatory mechanism must be based on a thorough understanding of the community's social, economic, and political structure. Moreover, it should be recognized that both fuel-oil surcharges and emission taxes permit quantity decisions to be made in a decentralized manner (i.e., by suppliers and distributors), while quantity controls result in a very centralized decisionmaking procedure (i.e., by air-pollution authorities). A determination of which is better obviously depends on who has access to the best information.

Our research has shown, however, that quantity controls, while successfully employed on several occasions, should be discouraged due to the severe degree of responsibility they place on the local pollution-control authorities. Since misjudgment or poor information* can result in significant social, economic and political upheaval from a shortage of fuel oil during the heating season, such controls are clearly a high-risk option.

The selection of either a fuel-oil surcharge or an emissions tax also involves a tradeoff. Emission taxes are conceptually the most efficient control mechanism since they permit the widest polluter discretion on abatement alternatives. These taxes, however, are not operational due to the inherent legal complexities and additional manpower demands with the assessment of the emissions charges.+

*Additional information on regional quantitites of fuel oil would be of great assistance to air-pollution agencies in establishing their variance policies. In this respect, the federal government can assist these agencies by encouraging or implementing the publication of price and quantity information on a regional basis. It has been apparent that existing information sources (e.g., *Oil Buyers' Guide*) are virtually inoperable for setting a fuel-oil surcharge when dynamic market conditions exist. Without minimizing the difficulties associated with this policy, it is advisable that these issues be considered.

+Appendix A reviews an additional consideration that a policymaker should be aware of concerning the use of an effluent charge strategy.

A general variance coupled with a fuel-oil surcharge, however, presents a very desirable policy alternative. This variance strategy minimizes the discretionary and informational demands on the administrator and does not subject him to the high-risk characteristics that surround quantity-control allocation programs. Where there are legal and political overtones to such fuel-oil surcharge policies, it is expected that they are not as significant as the inherently more complex regulatory policy of emission taxes. Moreover, the inherent overtness of the published, documented fuel-oil surcharge-rate structure tends to remove any incentive for outside influence over the regulatory authority. Obviously, there is a risk involved in any policy. If a surcharge is set too low, the surcharge can cause the introduction of an excess amount of high-sulfur fuel oil, while if the surcharge is set too high there exists the possibility of fuel-oil shortages. This was particularly evident in New York City where rent controls were in effect. Since the increased costs of fuel oil could not be passed through to the tenants, the surcharge could induce landlords to either reduce or completely eliminate heat to residents. Nevertheless, a general variance policy with a fuel-oil surcharge presents many characteristics that recommend it for future consideration.

A modification, however, of the general variance with a fuel-oil surcharge scheme (as employed by the NYC EPA) is recommended for future application of this policy. The legally mandated equality requirement between the price of conforming fuel oil and the price (i.e., with the surcharge) of nonconforming fuel oil in New York City would, in theory, lead to indifference between oils containing different levels of sulfur and thus leave in question the supplier incentives. It can be inferred that because of the dynamics of market prices (i.e., rapidly increasing prices), an incentive did seem to be realized favoring the supply of low-sulfur oil in New York City, notwithstanding the equality constraint. This must be interpreted as sheer happenstance, however, and it suggests the following modification. To *assure* desirable (as opposed to neutral) incentive characteristics, a fuel-oil surcharge

policy should be designed to *more* than compensate for the profit differential between conforming and nonconforming fuel oil That is, the surcharge rate should be sufficiently high so as to induce consumer-supplier discrimination against the high-sulfur oils.

APPENDIX A

This appendix analyzes the economic characteristics of an effluent-charge system whose structure is legally and politically confined as in New York City . Specifically, it will be demonstrated that such ethically satisfying restrictions (i.e., equity of effluent charges) effectively thwart the realization of the efficiency properties as generally conceived in the literature.

Although the affected parties in New York City included firms, households, hospitals, and schools, the model presented is based on the theory of the firm for simplicity of exposition. Moreover, in order to minimize notational complexity, we posit a competitive industry and focus on two firms whose effluents impinge on each other's costs. Each firm is assumed to be engaged in the production of only one good, q. The cost function for the firms are:*

$$C_1 = C^1(q_1, E_2) \quad \text{and} \quad C_2 = C^2(q_2, E_1)$$

where C_i is the total cost incurred by firm i at output q_i and when subjected to effluent E_j from firm j. Also we posit that $\partial C_i/\partial q_i > 0$ and $\partial C_i/\partial E_j > 0$, for i = 1, 2; i ≠ j; and j = 1, 2. The effluent will be viewed as a by-product of the production process,+ that is, $E_i = E^i(q_i)$;

*This analytical construct is analogous to Davis and Winston, "Externalities, Welfare, and the Theory of Games," *Journal of Political Economy*, LXX (June 1962), 241-262.

+This is compatible with the literature on environmental economics. For example, see D. Ethridge, "The Inclusion of Wastes in the Theory of the Firm," *Journal of Political Economy*, LXXXI No. 6 (1973), 1430-1441.

where $\partial E_i/\partial q_i > 0$, $i = 1, 2$. P denotes the competitive market price of q, and we assume that there are no externalities in the consumption of q. By assumption, firm i attempts to choose a $\hat{q}_i$ which maximizes

$$\Pi_i = Pq_i - C^i(q_i, E_j),$$

which requires that $\hat{q}_i$ satisfy

$$P = \partial C^i/\partial q_i, \qquad i = 1, 2 \tag{1}$$

i.e., the firm should set price equal to marginal cost.*

Employing the standard result that in a competitive setting the social optimum is attained by maximizing the net value of the production effort, society's objective can be written as:

$$\text{MAX } S = P(q_1 + q_2) - C^1(q_1, E_2) - C^2(q_2, E_1),$$

hence, the socially optimal outputs, q_1^* and q_2^* must satisfy

$$P = \frac{\partial C^1}{\partial q_1} + \frac{\partial C^2}{\partial E_1} \cdot \frac{\partial E_1}{\partial q_1}, \quad \text{and}$$

$$P = \frac{\partial C^2}{\partial q_2} + \frac{\partial C^1}{\partial E_2} \cdot \frac{\partial E_2}{\partial q_2}. \tag{2}$$

where

$\frac{\partial C_i}{\partial E_i}$ is the marginal damage measure.

*The second order sufficient condition is that $\frac{\partial^2 C^i}{\partial q_i^2} > 0$, i.e., the marginal cost curve must be rising at its point of intersection with the horizontal price line. Here, and elsewhere in the report, we assume the second order conditions are satisfied. This assumes the various functions are traditionally shaped.

As usual, we may observe from comparison of (1) and (2) that in the presence of cost-effective externalities the competitive market is socially inefficient; that is,

$$q_1 \neq q_1^* \quad \text{and} \quad q_2 \neq q_2^* \tag{3}$$

Inequalities (3) are the *raison d'etre* of the classical tax-subsidy approach, and the reasoning behind this approach is well accepted. Equation (1) must now be adjusted so that it yields the same solutions as equation (2). To this end, if Z_i is defined as a per-unit-of-effluent tax on firm i, the firm's maximum profit becomes

$$\text{MAX } \Pi_i = Pq_i - C^i(q_i, E_j) - z_i E_i$$

for $i = 1, 2$; $j = 1, 2$; $i \neq j$. The resultant optimizing outputs, $\bar{q}_i$, satisfy

$$P = \frac{\partial C^i}{\partial q_i} + z_i \frac{\partial E_i}{\partial q_i}, \quad i = 1, 2 \tag{4}$$

Therefore, by setting $z_i = \partial C^j / \partial E_i$, the equality of $\bar{q}_i$ and q_i^* is assured. Next we impose the equity criterion via the following definitions:

Definition 1-

If we assume that the physical character of the effluents are identical, the *equity criterion* can be imposed symbolically by requiring z_i to be equal to z_j. Specifically, if the two firms' emissions are identical, then their tax penalties must be identical (i.e., only the characteristics of the firm's discharge matters, not whether the company's name is i or j).

Definition 2-

An externality is *symmetrically reciprocal* if

$$\frac{\partial C_i}{\partial E_j} = \frac{\partial C_j}{\partial E_i}$$

In other words, effluents inflict damages reciprocally and identically.

Theorem (Necessary Condition for Equity)

A necessary condition for the equity criterion to be satisfied by a socially optimal effluent-charge system is that the external linkage be symmetrically reciprocal.

Proof

A socially optimal effluent charge was characterized above by

$$z_i = \frac{\partial C_j}{\partial E_i}$$

The equity criterion requires that $z_i = z_j$, therefore,

$$\frac{\partial C_j}{\partial E_i} = \frac{\partial C_i}{\partial E_j}$$

Hence, the external linkages must be symmetrically reciprocal by Definition 2.

This result demonstrates that the seemingly innocuous equity requirement is a severe restriction on the efficiency of effluent charges. Indeed, the theorem argues that, in general, effluent charges that satisfy this condition will never be efficient since unidirectional external linkages are prohibited. The fact that there exist established meteorological patterns precludes this constrained effluent tax from efficiently guiding production in the Pigouvian tradition.

The objection might be raised that firms produce physically distinct effluents. Obviously, this objection renders inapplicable the

preceding arguments. Even when effluents differ in physical character, however, there will tend to be an overriding equity consideration in the effluent rate setting process, and the potency of this influence will determine how closely the implications of the above theorem are approximated. Moreover, it must be recognized that for reasons of proximity to markets and raw resources, climatic and geographic considerations, firms of the same industry often locate in the same area. Thus, if symmetric reciprocity does not prevail, an effluent charge policy cannot yield an optimal resource allocation when subject to the equity criterion.

As a final note, it is appropriate to mention that a similar analysis could be constructed concerning a jurisdiction wide equity requirement for a fuel-oil surcharge or quantity control policy; however, since these concerns are of a second-order nature, they are not directly addressed in this report.

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SECTION II

NEW YORK CITY PERSPECTIVE

BACKGROUND

By 1972, low-sulfur residual fuel oil represented approximately fifty percent of New York City's annual energy consumption. Virtually all of this residual oil was derived from foreign crude oils and over ninety percent was imported from Caribbean refineries. New York City's unique dependence on *imported low-sulfur residual fuel oil* is a result of both legal and economic forces. First, since domestic refineries were heavily capitalized for gasoline and distillate production, the production of residual fuel oil is not as profitable as the other refinery products and, in fact, frequently sold below the price of the original crude oil. Moreover, since the Mandatory Import Program* severely restricted crude-oil imports, domestic refineries did not have a sufficient supply of crude oil necessary to facilitate expansion. As a result, Caribbean refineries geared for the production of residual fuel oil were developed (in fact, up to sixty percent of their output is residual oil as opposed to seven percent for domestic refineries). Second, environmental laws passed during the mid- to late-1960s banned the use of high-sulfur fuels and coal, and these laws caused an increased dependence on low-sulfur residual fuel oils.

*The Mandatory Import Program, established in March of 1959, limits importation into the U.S. of oil to 12.2 percent of the estimated domestic production of crude oil and natural gas.

There are five primary suppliers of low-sulfur residual fuel oil in New York City. These suppliers produce their low-sulfur residual oil either by using "sweet" low-sulfur crude oils, by desulfurizing in hydrodesulfurization units, or by blending higher-sulfur residual oils with lower-sulfur distillate oils. The relative scarcity of sweet crudes and the high cost of desulfurization act as effective constraints on the supply of low-sulfur oil. On the demand side, since the use of high-sulfur oil (i.e., fuel oil with a sulfur content above 0.3 percent) is prohibited, there is a relatively inelastic demand for the higher-cost low-sulfur product.

1972-73

During the early winter of 1972-73, various oil suppliers, terminal operators, and distributors expressed fears of a shortage of conforming (0.3 percent) residual fuel oil in New York City. As early as November of 1972, at least one of the City's major terminal operators had requested federal intervention in order to make additional supplies of residual fuel oil available from major suppliers in the Caribbean. The first formal contact in New York City occurred on December 27, 1972, when a major distributor asked New York City's Environmental Protection Administration (NYC EPA) to relax the City's limitations on the sulfur content of fuel oil. As a result, the NYC EPA made several inquiries to federal and state authorities in an effort to assess the "tightness" of the City's fuel-oil market. These inquiries proved unavailing. Opinions were diverse, and neither state nor federal officials could substantiate the existence of a fuel-oil crisis in New York City. Nevertheless, local officials recognized that a serious problem existed and that the City would have to develop a strategy to cope with the anticipated fuel-oil shortages. This section explores that strategy.

As the winter progressed, more ominous predictions of the forthcoming events developed. On January 2, 1973, a major fuel-oil supplier

(Supplier A) who accounts for approximately fifteen percent* of the City's residual fuel-oil sales (and about thirty percent of the residual oil used for space-heating), duplicated the previous informal request for relaxation from the City's Air Pollution Control Code (and, hence, New York State's Environmental Regulations, which must also approve any variance request). Supplier A stated that crude-oil supply disruptions in Nigeria and refinery problems in Curacaco necessitated a variance from the standard 0.3 percent sulfur-content fuel oil to 2.5 percent content for 1,200,000 barrels in January, to 2.0 percent for 900,000 barrels in February, and 2.0 percent for 750,000 barrels in March of 1973. In view of the many uncertainties regarding the degree of market tightness and the lack of substantiation from Supplier A, the City's officials decided on January 11, 1973, to respond to the company in a way that granted no immediate relief, but left the door open for further informal discussion on the submission of a formal petition for relief.

A second major supplier (Supplier B), who accounts for approximately ten percent of the City's residual fuel-oil market, formally petitioned for a variance on January 18, 1973, only three days after the company had expressed cautious optimism concerning its supplies of fuel oil. Supplier B claimed that supply disruptions in the Middle East and delays in completing new desulfurization facilities required relaxation of sulfur-content standards to 2.8 percent for 450,000 barrels of oil during the months of January, February, and March. The next day, Supplier A also submitted a formal petition, modified from its original request, requesting authorization to use 2.5 million barrels of fuel oil with a sulfur content of one percent.

It was apparent that there was an economic incentive for oil suppliers to overestimate the extent of their shortfall. The distorted fuel-oil

*The figures on market shares of the City's residual fuel-oil market are approximations. The five major fuel-oil suppliers account for approximately seventy to eighty percent of the residual-oil market.

market had led to substantial price differentials between fuel oils of varying sulfur contents. For instances, the New York City Harbor postings for residual-fuel oil in January of 1973, as reported by the *Oil Buyers' Guide*, were $4.80 per barrel for 0.3 percent sulfur oil, $3.95 per barrel for one percent sulfur and $2.45 per barrel for 2.8 percent sulfur oil. Moreover, based on a survey of jobbers and consumers, it appeared that few buyers were contractually protected against substitution of the cheaper higher-sulfur oils for conforming fuel oil.

Thus, it was apparent that the difference in price between conforming and nonconforming oils would accrue to the suppliers, distributors, and ultimate consumers of high-sulfur fuel oil in some unpredictable combination, depending on the market leverage of these three groups. Such economic windfalls accrue at the expense of the citizenry in general, whose health and well-being ultimately suffers from increases of sulfur dioxide in the air. Since the cost of relaxing environmental standards was to be borne by the general public, it seemed only equitable that economic compensation be accrued by the public in general, rather than by any particular suppliers, distributors, or consumers. Furthermore, the existence of an economic incentive for specific individuals or corporations to burn high-sulfur fuel would logically induce them to prefer nonconforming oil over conforming oil. For government to allow such an incentive to exist would be irresponsible and intolerable.

A second major consideration was that if a variance to sell nonconforming oil were granted to the petitioners alone, then other companies who might be able to provide lower-sulfur fuel oil would be unable to compete in sales. The City had no intention of protecting the petitioner's market shares in view of their alledged inability to provide low-sulfur oil. Therefore, the NYC EPA decided that both price competition and sulfur competition should be maximized if a variance were to be granted. In addition, because manpower constraints could hamper the issuance and implementation of specific variances, the NYC EPA also decided that a group variance would be granted to all suppliers to sell nonconforming oil.

On January 24, 1973, the NYC EPA issued a variance to relax the City's sulfur restrictions. This general variance granted temporary relief from January 25, 1973, to March 10, 1973, to the petitioners and all other fuel-oil suppliers to transport, store in aggregated facilities, offer for sale, and sell residual fuel oil with a sulfur content not exceeding one percent to authorized buyers.* Moreover, Supplier B and, subsequently, on February 11, 1973, Distributor X were granted general variances for two percent residual oil under the same terms as the January 24th variance. Specifically, Supplier B, which had requested relaxation of sulfur standards for 450,000 barrels, was issued a variance for 300,000 barrels after it had been determined that 150,000 barrels of nonconforming oil destined for Consolidated Edison, which supplies the City's electricity, would not be needed (Consolidated Edison opted to reduce its inventories). Distributor X was also granted its entire request for a variance for 455,903 barrels of two percent sulfur-content residual fuel oil.

In addition to issuing a general variance, the City required that a surcharge be paid equal to the total number of barrels of nonconforming oil multiplied by seventy-five cents for those barrels containing between 0.3 and one percent sulfur content and multiplied by two dollars for those barrels containing between one and two percent sulfur-content fuel oil. The level of the surcharges attempted to set the price of

*In order to be designated as an authorized buyer, a person or corporation was required to petition the City's Department of Air Resources and demonstrate his contractual rights to specific quantities of conforming oil, which his supplier had been unable to provide. The authorized buyer was also required to indicate his current consumption or resale needs, his inventory of fuel oil, and the anticipated arrival date of his next shipment of conforming oil from alternate suppliers. Each applicant was required to contact other fuel-oil suppliers in an attempt to obtain lower-sulfur oil. To simplify the application process, the Department of Air Resources prepared a standard short-form petition and supporting affidavit (see appendix B) which were provided in quantities to potential applicants and suppliers.

nonconforming oil at the same level as that of the low-sulfur conforming residual fuel oil. In essence, the general variance coupled with a fuel-oil surcharge opened the market for nonconforming oil while preventing a monopoly profit from being granted to those suppliers and distributors who could not conform. This variance strategy also promoted sulfur competition by encouraging the entry of more nearly conforming grades while avoiding shortages. Since the NYC EPA is not a legislative body, it does not have the power to levy taxes; and since it is not a judicial body, the NYC EPA does not have the power to fine or penalize behavior. Therefore, the surcharges were described as "conditions of the variance," and these conditions had the effect of law and were enforceable in the courts. The legal justification for the surcharges was that the NYC EPA was using a device that enabled more efficient and equitable exercise of their administrative powers.*

New York State's decision in regard to sales of nonconforming fuel oil did not include fuel-oil surcharges. The decision, however, did require that any economic benefits resulting from the use of nonconforming oil accrue to the public. Both the City's and State's attorneys believed this requirement to be consistent with the condition of the City's decision. Further, by designating the NYC EPA as the State's agent for designating authorized buyers in the City, the State was able to centralize the decision-making process while proceeding in consonance with the State's regulatory procedures.

Overall, the general variance with the fuel-oil surcharge seemed to operate effectively. High-level City officials speculated that the

*The City's Air Pollution Control Code sets emission standards and delegates power to grant variances to the administrator of the City's EPA. The New York Department of Environmental Conservation sets emissions standards for the State. Any exceptions from the State standard, which is identical to the City's standard, have to be made following a certification by the New York Public Service Commission of a shortfall of conforming oil and must be approved by the Federal Environmental Protection Administrator. It has been generally thought that while the City and State laws have concurrent application, when both agencies issued a variance, the stricter ruling prevails.

institution of economic conditions in the five boroughs of New York City, combined with the omission of economic conditions in the three outlying counties of the metropolitan area, subsequently prompted the shipment of relatively more nonconforming fuel into the fringe areas than into the center city. Such an effect was environmentally desirable since ambient pollutant concentrations are much higher in New York City than in neighboring Nassau, Westchester, and Rockland Counties.

Despite the apparent success of the program, the variance strategy did cause some problems. Distributor Y, for example, refused to supply fuel oil to New York City's Housing Authority and Board of Education if the surcharge were enforced since contracts for the purchase of fuel by the City's agencies contained clauses that invoked penalties and/or price reductions if nonconforming fuel was supplied. In effect, the surcharges would have invoked dual compensation to the public. In order to eliminate this oversight from the original variance scheme, a supplemental variance was issued on January 31, 1973, that provided that suppliers and/or distributors who delivered nonconforming oil for ultimate consumption by public-sector agencies subjected to financial adjustment would be exempt from the fuel-oil surcharge. Another supplemental variance was issued on March 5, 1973, when Distributor Y notified the Department of Air Resources that it could supply 100,000 barrels of residual oil with sulfur content of 0.35 percent. The distributor claimed that it was unfair to pay the entire seventy-five cents per barrel as required by the January 24th variance because the price differentials between 0.3 and 0.35 sulfur content were less than seventy-five cents. After careful consideration, the City agreed to a surcharge of 5.357 cents per barrel for this oil.

By the end of the heating season, Supplier A, which had originally calculated a need for 2,850,000 barrels and, subsequently 2,500,000 barrels of nonconforming fuel oil, found it necessary to supply only 865,796 barrels of nonconforming residual-fuel oil. Of this total,

501,630 barrels of nonconforming oil were sold to the City's agencies and 6,095 barrels were sold outside New York City and were exempt from the seventy-five cents per barrel surcharge. Thus, a total of 358,071 barrels were subject to the surcharge and Supplier A paid $268,553.25 to the City. Supplier B, which had originally calculated a need for 450,000 barrels of nonconforming oil, found it necessary to supply only 216,602.83 barrels of nonconforming residual fuel oil, all of which was subjected to the two-dollar surcharge. Supplier B paid $433,205.66 to the City. In total, slightly more than 1,700,000 barrels of nonconforming residual oil were sold in New York City and just over $1,500,000 was collected as a condition of the variance.

1973-74

The winter of 1973-74 was characterized initially by the Arab oil embargo on October 16, 1973, by the subsequent "energy crisis," by the advent of federal energy policies, and by the interaction of multiple price-control systems that tended to differentially effect imported versus domestic oils. Moreover, there was an interregnum in the City and State governments, the establishment of the Federal Energy Office in Washington, D.C., and congressional legislation to amend the Clean Air Act of 1970. Therefore, policymaking was complicated during the winter by changes of officials and policies at the City, State, and Federal levels.

The East Coast, and New York City in particular, was affected more severely than the rest of the country by the oil embargo because of the area's heavy dependence on imported fuels. After December 1973, however, requests for variances declined because of a mild winter and conservation efforts that resulted in a reduction of fuel usage from twenty to twenty-five percent. Thus, most questions of policy were decided before the end of 1973.

Consolidated Edison, the City's electric utility, made the first request for a variance from the sulfur-content regulations. The company

sought to use nonconforming fuel oil at all its facilities and coal at the utility's Ravenswood Unit No. 3 and Arthur Kill Unit No. 3 (these two units account for approximately twenty-five percent of Consolidated Edison's residual fuel-oil usage). On November 12, 1973, a joint hearing of City and State authorities along with Consolidated Edison's representatives and the utility's suppliers was held in order to determine the extent of the shortfall of residual fuel oil.

Consolidated Edison estimated a need for 21.5 million barrels of residual fuel oil during the five-month period from November 1, 1973, to March 31, 1974. The utility estimated that during this five-month period they would receive 1,400,000 barrels from Supplier B, 900,000 barrels from Supplier C, 4,200,000 from Supplier D, and 10,200,000 barrels from Supplier E, for a total of 16,700,000 barrels of conforming residual fuel oil. Since Consolidated Edison had approximately 3,200,000 barrels of conforming fuel oil in reserve (of which about 700,000 accounts for the utility's required inventory), there was an estimated shortage of between 2,300,000 and 4,800,000 barrels of conforming residual fuel oil.

Because of the absence of complete information regarding the demand and supply conditions during the five-month period, the NYC EPA estimated that the utility would be short 3,000,000 barrels of low-sulfur residual fuel oil after using 1,800,000 barrels from reserves. On November 19, 1973, in addition to granting a variance to Consolidated Edison for the use of 3,000,000 barrels of nonconforming fuel oil, the City issued a general variance to all suppliers to sell such oil. As in the previous winter (1972-73), a fuel-oil surcharge was imposed (in order to eliminate windfall profits), and authorized buyers had to be designated through a short-form process. The surcharge was again designed towards equalizing the price differentials between conforming and nonconforming fuel oils. Specifically, a supplier had to pay to the City an amount equal to the total number of barrels of nonconforming oil multiplied by twenty-five cents for those barrels containing greater than 0.3 and less than 0.5 percent sulfur; one dollar

for those barrels containing more than 0.5 percent and less than one percent sulfur; two dollars and fifty cents for those barrels containing greater than one and less than two percent sulfur; and three dollars for those barrels containing greater than two and less than three percent sulfur. The NYC EPA, however, rejected authorization for the use of coal since the authorities expected a national, or at least a regional, plan that would allocate coal to the least environmentally sensitive areas.

As in the previous year, state officials were required by law to verify a shortage of fuel oil, and they certified an absolute shortage of both conforming and nonconforming residual fuel oil. Therefore, on November 27, 1973, in contrast to the City's decision on coal, the State issued a variance permitting Consolidated Edison to use coal at the Arthur Kill Unit No. 3 and Ravenswood Unit No. 3 facilities and 1.5 percent sulfur-content residual fuel oil in unlimited quantities (provided efforts had been made to secure conforming oil) until March 31, 1974.

Thus, both the public and Consolidated Edison were somewhat confused. The City took the position, and the State seemed to agree, that both City and State agencies possessed concurrent jurisdiction and that the stricter variance prevailed. This resolution meant that coal could not be used (under the City's variance) and that the sulfur content of nonconforming fuel oil had to be restricted to 1.5 percent (under the State variance). Moreover, the United States Environmental Protection Agency had the right to accept or reject the State's variance because of their authority to review changes of the State's air-quality implementation plan under the Clean Air Act of 1970.

Early in December of 1973, a series of meetings between representatives of the City, State, and Federal governments and officials of Consolidated Edison resulted in the formation of a plan for the use of coal in the least environmentally sensitive areas. On December 13, however, the United States Environmental Protection Agency reversed the State's

variance plan for the Ravenswood unit, but approved the plan for the Arthur Kill unit. As a result, the City's variance plan was amended to comply with the United States Environmental Protection Agency's decision. Moreover, the NYC EPA imposed a surcharge on coal similar to the fuel-oil surcharge, which was designed to make coal as expensive as conforming fuel oil.*

Later, on December 21, Consolidated Edison obtained an injunction against the levying of the surcharge. Despite the injunction, the City's officials were convinced the surcharge would have to be suspended because market prices were rapidly changing and the rationale for the surcharge was being undermined. Specifically, although most of the residual fuel oil entering the City was derived from imported crude oils, a multitiered market had developed. Supplier E was extremely short of crude-oil supplies (because of the Libyan embargo) for the company's Bahamian refinery (which was experiencing technical difficulties) and declared *force majure* on its contractual obligations. Normally, a supplier would purchase oil on the spot market in order to fulfill contractual agreements. The spot price for conforming oil, however, exceeded twenty dollars per barrel, and it was reported that some oil was offered as high as twenty-seven dollars per barrel. Since the price of 0.3 percent sulfur-content oil had been only $4.80 per barrel earlier in the year, it was evident that the oil market was in a state of chaos.

Other suppliers were able to deliver oil at various prices depending on their supply conditions, and most buyers purchased oil despite the

*The determination of the coal surcharge was complicated because of the absence of a coal publication similar to the *Oil Buyers' Guide*, and the City was forced to rely on historical prices (Consolidated Edison insisted that the level of the surcharge was so high as to make the use of coal economically infeasible). In addition, there was no systematic price difference between grades related to sulfur content. Therefore no attempt was made to construct a variance differentiating between sulfur contents, and an arbitrary upper limit was set on sulfur and ash contents.

price. Suppliers were thus forced to allocate oil to their regular customers. Supplier C, for example, also declared *force majure*, freeing the company from its contractual agreements, and it then proceeded to allocate oil to its customers at the rate of eighty-five percent of the stated contractual obligation. Moreover, the supply was nonconforming oil and the price exceeded the previous month's price of conforming residual fuel oil.

Although in December of 1973 it was possible to purchase oil in the spot market, the spot-market prices of conforming residual fuel oil were rising so precipitously as to virtually remove this option. Moreover, on December 12, the Federal government published a proposed allocation program that would lock-in the supplier-buyer relationships based on previous contracts. Thus, once the regulations became effective, there would be no more "shopping" for oil.

As a consequence of these changes, the rationale for the surcharge was gone. Searching the market for low-sulfur residual fuel oil was no longer practical and would soon be legally prohibited. The stability of the high/low sulfur-content price relationship was disrupted and the effect of the surcharge was becoming arbitrary. Because oil prices had more than tripled in a short period and because price controls on terminal operators and distributors were in effect, it became increasingly difficult to prove to the courts the existence of windfall profits. In fact, one manufacturing company revealed that it was currently paying more for higher-sulfur fuel oil ($7.67 per barrel) than it was paying for lower-sulfur fuel oil ($6.90 per barrel) only ten days earlier. The company also claimed that no fuel-oil supplier was willing or able to provide the firm with additional supplies of oil. Moreover, Consolidated Edison argued in their lawsuit that the imposition of the surcharge was not within the City's authority. Although the City's lawyers were prepared to defend the City's authority to impose the surcharge, they decided not to contest the injunction. On December 27, 1972, the City revoked the surcharges while reserving the right to reimpose similar surcharges at a later date.

APPENDIX B

PETITION AND AFFIDAVIT FORMS

ENVIRONMENTAL PROTECTION ADMINISTRATION
CITY OF NEW YORK

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In the Matter of the Application of

_____

for a Variance from the Provisions of
Section 1403.2-13.03 of the Air Code

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Pursuant to Section 1403.2-3.11 of the New York City Air Pollution Control Code, _____ respectfully for relief from the provisions of Section 1403.2-13.03 of the Code and for authority to purchase _____ barrels/gallons of regular grade no. _____ fuel oil with a sulfur content of _____ percent on a dry weight basis.

The following affidavit is offered in support of said petition.

_____

By _____

STATE OF NEW YORK
COUNTY OF SS.:

_____ being duly sworn, deposes and says:

1. That petitioner's present inventory is _____.

2. That attached hereto is a true copy of the contract executed by and between petitioner as purchaser and _____ as supplier of _____.

3. That _____ is unable to deliver _____ of such fuel oil due petitioner under the terms of said contract.

4. That petitioner's consumption requirements for such fuel oil/ or obligation to delivery such fuel oil for the period from _____ to _____ are _____.

5. That the next scheduled date for delivery of conforming fuel oil to the petitioner is _____.

6. That petitioner has made the following efforts to obtain conforming fuel oil and/or fuel oil with a lower sulfur content than that which petitioner seeks relief to purchase:

_____

Sworn to before me this

_____ day of _____, 19____

SECTION III
THE REGIONAL PERSPECTIVE

NEW JERSEY

1972-73

Although New Jersey is heavily dependent on residual fuel oil, the State's policy regarding variance requests was quite different from that of New York City. Because of the characteristics of New Jersey's residual fuel-oil market, the state's air-pollution-control authorities were able to follow a strict, no-variance policy during the winter of 1972-73. Specifically, Supplier D which maintains both refinery and desulfurization facilities in New Jersey, accounts for approximately seventy percent of the state's residual fuel-oil market while Supplier C represents about twenty-five percent, and smaller concerns servicing the remaining five percent of the market.

During the 1972-73 winter, the two largest suppliers had no serious difficulties with respect to supplies of conforming residual fuel oil. There were, however, informal requests for variances from some of the state's smaller suppliers. Investigations by New Jersey's Bureau of Air Pollution Control (Department of Environmental Protection) showed that, if necessary, consumers could obtain oil from alternative suppliers and consequently all requests for variances were refused. Hence, the Bureau was able to manage requests for fuel-oil variances based on informal personal contact between suppliers, distributors, and consumers.

1973-74

Events during the winter of 1973-74, however, posed a more serious threat to New Jersey's air-quality. In October and November of 1973, in addition to public hearings, a series of investigations were undertaken by New Jersey's Legislature, by the governor's office, and by other State agencies to determine whether a relaxation of the sulfur-content regulations for fuel oil was warranted.

It was determined that shortages were probable and a temporary modification of the State's sulfur-content regulations was adopted. From November 20, 1973 until March 15, 1974, the sulfur-content restrictions on fuel oil were differentially relaxed throughout the State on the basis of air-shed-tolerance considerations. The new regulations relaxed the allowable sulfur content of residual fuel oil from 0.2 percent to 0.5 percent in urban areas and from 0.2 percent to one percent in the remainder of the State.

Although these new regulations made fuels available that would have been otherwise restricted, officials still found it necessary to retreat from the State's original variance strategy and to issue variances to the already relaxed restrictions. The variances were necessitated because, unlike the 1972-73 winter in which only a small number of fuel-oil suppliers requested variances, the 1973-74 winter witnessed Supplier C experiencing a shortage of conforming residual fuel oil.

All 285 variances formally requested by customers of Supplier C were granted. The procedure established by the New Jersey Department of Environmental Protection for issuing a variance involved a petition from the customer, certification of the shortage from the supplier, and a decision from the Department (see appendix C). Specific (i.e., individual) variances stating the quality, quantity, and duration of the relaxed restrictions were issued at the discretion of three full-time administrators, who utilized information furnished primarily

the potential public health and safety problems as well as the political consequences if shortages actually developed. As a result, on November 30, 1973, a variance to the State's sulfur regulation was issued. The variance allowed Northeast Utilities, the State's largest supplier of electrical power (the company supplies approximately two-thirds of the State's electricity) to use nonconforming fuel oil with a sulfur content not exceeding 1.25 percent for 120 days. Moreover, the variance also allowed the utility to use coal if the utility's fuel oil supply fell below a twenty-five day inventory. The variance required that any coal used by the utility must have an average sulfur content of less than two percent. By the end of the variance period, the utility had used no coal and only a small amount of nonconforming residual fuel oil.

On November 27, 1973, Supplier E and a distributor (both located in Massachusetts) informed State authorities that the companies would no longer be able to supply their Connecticut customers with conforming residual fuel oil. On December 19, 1973, public hearings were held and the companies explained they were confronted with storage rather than availability problems. State officials granted a variance for the unlimited use of one percent sulfur content residual fuel oil until May 1, 1974, provided the company's made efforts to either construct or secure storage facilities.

APPENDIX C

PETITION AND CERTIFICATION FORMS

County of _____
:SS
State of New Jersey

1. My name is _____. I am employed by _____ as _____. I possess to swear to the truth of the representation made in this certification and to bind _____ thereto.

2. Due to circumstances beyond any reasonable degree of its control _____ will not be able to sell or deliver in New Jersey from _____
(date)
until _____, No. 5, No. 6 or heavier grade
(date)
fuel oil having a sulfur content conforming to the provisions of N.J.A.C. 7:1-3.1.

3. On the basis of the most reliable information available to it at this time, _____ will, subject to available supplies, be able to sell or deliver No. 5, No. 6 or heavier grade fuel oil having a sulfur content not greater than _____% in the Counties of Union, Essex, Hudson, Bergen and Middlesex, and not greater than _____% sulfur in any other county in New Jersey.

4. _____ will not sell or deliver No. 5, No. 6 or heavier grade fuel not conforming to the provisions of N.J.A.C. 7:1-3.1 to any person not in possession of a valid variance issued by the Commissioner of the New Jersey Department of Environmental Protection authorizing the use of No. 5, No. 6 or heavier grade fuel oil not conforming to the provisions of N.J.A.C. 7:1-3.1.

5. _____ will notify the Commissioner of the Department of Environmental Protection within ten days of any change in circumstances which will enable _____ to sell or deliver No. 5, No. 6 or heavier grade fuel oil conforming to the provisions of N.J.A.C. 7:1-3.1.

6. _____ makes this certification with full knowledge that the Department of Environmental Protection relies on the statements made herein.

through petition forms and telephone communication with representatives of the various fuel-oil suppliers.

MASSACHUSETTS

1972-73

Suppliers of residual fuel oil are essential to Massachusetts despite a State law that prohibits the use of such oil in facilities utilizing less than three million BTU (British Thermal Units) per hour. In fact, utilities, hospitals, schools, large industries and large apartment complexes account for the consumption of eighty-four million barrels of residual fuel oil per year in Massachusetts.

During the latter part of 1972, both the major and independent fuel-oil suppliers submitted formal petitions for variances to the State's sulfur regulations. In response to these variance requests, Governor Francis W. Sargent created a task force to investigate the alledged fuel-oil shortage and to recommend policy alternatives. Public hearings were also held during January of 1973, to review the petition submitted by a subsidiary company of Supplier B. Massachusetts' officials, recognizing the authenticity of the claimed shortages and the potential seriousness of the problem, decided to issue a general variance to the State's air-pollution regulations. The decision to grant a general variance as opposed to specific (i.e., individual) variances was based on considerations of administrative expediency (i.e., time and manpower constraints).

The general variance was for a thirty-day period ending February 28, 1973, and it relaxed sulfur restrictions in the Boston area* from 0.5 percent to one percent sulfur content residual-fuel oil. For unknown reasons, only a small quantity of nonconforming residual fuel oil actually entered the Boston area. On a strictly speculative basis, this result can be explained by the fact that one percent sulfur-content fuel oil was also in extremely short supply. Specifically, the

*The Boston area is comprised of the City of Boston and twelve surrounding communities.

nonlinear characteristics of the fuel-oil surcharge imposed in New York City may have influenced the fuel-oil market in Massachusetts. Since New York City represents a significant portion of the northeastern residual fuel oil market, the City's surcharge tended to induce suppliers to use the lower-sulfur-content nonconforming fuel oils before resorting to the higher-sulfur-content supplies. That is, because of New York City's variance strategy, the demand for one percent residual fuel oil was accentuated.

Western Massachusetts experienced a different situation from that of Boston. It should be recognized that because ambient air-quality represents less of a problem in Western Massachusetts than in Boston, authorities exhibited greater flexibility in dealing with variance requests originating outside of Boston. On November 21, 1972, in response to requests for relaxation of sulfur-content standards, a general variance was issued for Western Massachusetts permitting the use of up to 2.2 percent sulfur-content residual fuel oil from April 1, 1973 to October 1, 1973.

1973-74

As early as July of 1973, the major fuel-oil suppliers warned Massachusetts' authorities that the supply of conforming fuel oil for the following winter would be ten to fifteen percent short of the anticipated demand. Since these estimates excluded supplies from independent fuel-oil suppliers, which account for approximately forty-five percent of the Boston fuel-oil market, pressure mounted for relaxation of sulfur-content requirements.

Public hearings were held in September of 1973 to determine what policy should be taken in light of the predicted shortfalls for the upcoming winter. On November 2, 1973, State authorities adopted new regulations concerning the sulfur content of fuel oils. Specifically effective November 15, 1973 until Mary 15, 1974, the new residual fuel oil regulation permitted sources using more than 250 million BTU (British Thermal Units) per hour to apply for variances to burn residual oil up

to 2.7 percent sulfur content. Moreover, this new regulation stipulated that a three-day supply of 0.5 percent sulfur content fuel oil had to be maintained. This reserve would be utilized when adverse meteorological conditions warranted (as determined by State officials). In effect, the regulation permitted a discretionary fuel-switching program to be instituted. The same day, the State's authorities granted a variance to the New England Power Company to use 2.6 percent sulfur-content residual fuel oil from January 1, 1974 through October 1, 1974.

Specific variances were issued so that Massachusetts' authorities could exercise a greater amount of control over the allocation of non-conforming fuel oil. In essence, the State's officials attempted to prevent serious degradation in ambient-air quality by allocating non-conforming oil by location rather than by supplier.

Public response to the implementation of the State's variance strategy was overwhelming. State officials became swamped with variance requests from consumers. Because administrative consideration of variance requests took between twenty-five and sixty days, it was evident that modifications were necessary. On December 11, 1973, the regulations were amended in order to expedite the variance process for sources using as little as three million BTU per hour. These new regulations reduced the necessary time for granting variances to five days and required that consumers provide a statement from both their normal suppliers and alternative suppliers demonstrating inability to obtain conforming fuel oil. Although a relatively small number of variances were issued under this system, the number of requests still proved cumbersome. State authorities decided to further streamline the variance procedures by allowing suppliers to provide notification that conforming oil was not available in behalf of the company's customers (although customers were still required to submit requests in order to be considered).

Obviously, the success of the allocation scheme depended on the close and voluntary cooperation between suppliers and State authorities since no legal authority existed to force suppliers to allocate certain sulfur content fuel oils to specific customers. In fact, only a few companies cooperated, most notably the independent fuel-oil suppliers. The suppliers that did not cooperate were refused variances. In total, 674 variances were issued.

CONNECTICUT

1972-73

During the winter of 1972-73, Connecticut issued no variances to the State's sulfur-content regulations. There was one informal request for a variance from Supplier C. When the State's authorities required the company to certify the shortate, however, Supplier C did not pursue the variance request.

1973-74

In mid-October of 1973, Supplier C informed the State's utilities that the company would no longer be able to meet contractual obligations for conforming (0.5 percent) residual fuel oil. Supplier C sells fuel oil to approximately eighty percent of the State's utilities and they account for one-half of Connecticut's residual fuel oil consumption. On October 30, 1973, the utilities officially petitioned for a variance from the State's sulfur-content regulations.

On November 9, 1973, public hearings were initiated to consider the variance request. A definitive decision was delayed because of Supplier C's reluctance or inability to supply the State with documented evidence of a shortage and the State's inability to otherwise certify the shortage of conforming residual fuel oil.

As the winter progressed, State officials became less demanding in requiring documentation of the fuel-oil shortage since they recognized

7. I certify, based upon information, knowledge and belief, that the representations made herein are true.

Signed_____ for_____

Date:_____

STATE OF NEW JERSEY

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Application No._____

Reference: Administrative Order No. Thirty-Nine
New Jersey Administrative Cost 7:1-3.2
Temporary Variances For No. 5, No. 6 and
Heavier Grade Fuel Oils, Crude Oil and Coal

Dear

Under authority set forth in N.J.A.C. 7:1-3.3, SULFUR CONTENT IN FUELS the following action has been taken on your application dated _____ for an Emergency Temporary Variance for _____ located at _____ _____;

1. _ Your request dated _____ for a variance has been disapproved because _____ _____ _____

2. _ Authorization is granted to burn no more than _____ per week of _____ have a sulfur content not in excess of _____% by weight.

This authorization is subject to the following conditions:

1. (a) _ Compliance with N.J.A.C. 7:27-3 (formerly Chapter 4 of the New Jersey Air Pollution Control Code) must be maintained.

   (b) _ Authorization is granted to emit smoke the shade or appearance of which is: not darker than Number ____ on the Ringelmann Smoke Chart of greater than _____% opacity, exclusive of water vapor.

2. .(a) _ Compliance with N.J.A.C. 7:27-4 (formerly Chapter 5 of the New Jersey Air Pollution Control Code) must be maintained.

   (b) _ Authorization is granted to emit no more than _____ lbs/hr of solid particles

3. _ Changes filed with your variance application will be acceptable as your standby plans subject to N.J.A.C. 7:27-12 (formerly Chapter 12 of the New Jersey Air Pollution Control Code).

4. Others _____

_____

_____

This variance including all conditions is effective from _____ and terminates on _____ _____. Failure to comply with the terms of this variance may result in its cancellation and/or prosecution for violation of the New Jersey Administrative Code.